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UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
for
SOIL CONSERVATION SERVICE RESEARCH**
APRIL 1948

EROSION CONTROL PRACTICES DIVISION

Lesson Plan on String Method - T. L. Copley, Raleigh, N. C.-"A lesson plan for the Veterans Farmer Training Program, entitled: "Teaching the String Method of Row Layout", was prepared by A. G. Bullard, Subject Matter Specialist, Veterans Farmer Training, North Carolina Department of Public Instruction. Assistance was given with technical phases of the bulletin, and they have published a very worthwhile lesson plan. Directions for laying out the row system will go through the various agricultural instructors to the veteran students. The teaching plan calls for field demonstrations to supplement class room work. This should be an excellent channel for getting this very important practice in use by the veteran farmers."

Wind Erosion and Bare Ground - Ralph A. Cline, Brookings, South Dakota.-"Most of the 1st and 3rd weeks of the month were spent assisting Merritt E. Anderson, Observation Aid, with spring soil moisture and ground cover observations in the Clearfield-Keyapaha and the American Creek Soil Conservation Districts. The soil moisture situation in these two districts is considerably different this spring than it was year ago. The average depth of moisture penetration in the spring of 1947 on all fields sampled was 40 inches and this spring only 20 inches. Fall plowed fields, small grain and corn fields that were heavily grazed during the fall and winter months and fields summer fallowed (1947) with conventional tillage implements have suffered considerably from wind erosion. In some of the most severe cases, 2 to 3 inches of topsoil has been removed this spring. Approximately 30 percent of the fallowed fields that were seeded to winter wheat last fall were being reseeded this spring."

Control of Volunteer Wheat - F. L. Duley, Lincoln, Nebraska.-"In cooperation with Mr. Noel Hanson of the Department of Agronomy, tests were made of effect of 2,4-D on killing volunteer wheat. Plots sprayed December 2, 1947, showed as high as 95% kill on certain plots. Other types of sprays and lower concentrations were less effective. The cost of application of this chemical is high and may preclude its use for eradicating volunteer grain. We obtained almost 100% effective eradication of volunteer wheat by subtilling in fall at a shallow depth and then following with a skew treader. If this method continues to prove effective, it

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** All research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

would be much more economical than the chemical treatment. In addition, it would give a fall subtilling of the soil, which has been shown to be advantageous."

Russian Wild Rye in Dryland Pastures - O. K. Barnes, Laramie, Wyoming.-"In January, 1948 when the sheep were taking Russian wild rye in preference to five other grasses, samples were clipped from pure seedings of blue grama and Russian wild rye. These were given to Mr. Beath, Head of the Research Chemistry Department for chemical analysis. The results of this analysis are shown below.

	Elymus Jumceus (Russian Wild Rye)	Blue Grama
Moisture	7.39	6.58
Ash	10.93	9.13
Calcium	0.824	0.526
Phosphorus	0.488	0.435
Crude Protein	4.81	3.01
Ether extract	2.52	1.65
Crude fiber	30.63	31.73
Nitrogen free extract	43.71	47.93

"Considerable interest has developed this spring over the state in reseeding dryland to Russian wild rye for summer and winter pasture. Limited supply of seed is a limiting factor in use of this grass as yet."

Winter Erosion From Small Grain - B. H. Hendrickson, Watkinsville, Ga.-"Mr. A. P. Barnett made a special computation of selected soil losses to illustrate winter conditions. These are shown in the following table.

"For several years it has been noted that the practice of planting small grain following cotton using a tractor - drawn grain drill on disced land permits considerable winter erosion. This practice leaves the land relatively smooth, allowing more runoff and providing less surface detention than the small-farmer practice of planting small grain with a small mule-drawn furrow drill in the cotton middles.

"The exceptionally heavy 1947-48 winter rainfall caused the relatively high soil losses shown in the table, where oats were drilled on disced rowcrop land. Weather conditions in the fall delayed grain planting until November 1, consequently the winter cover was less effective than usual.

"The effect of these conditions was most noticeable on the Class IV land 11 percent slope plots 35 feet long. Here the soil losses from the scanty cover of oats exceeded by 34 percent those from continuous cotton.

"Summer legume residue sods of the lespedezas continued to furnish excellent winter erosion control under the same heavy rainfall conditions.

"Our expanding acreages of small grains using mechanized equipment poses a winter erosion - control problem of some importance. Apparently the best solution lies in the use of rotations which increase soil absorptability and erosion resistance, and tractor-drawn furrow grain drills which will not clog when operating in trashy seedbeds.

Soil losses during the winter period of November 1, 1947 - March 31, 1948 for selected cropping practices: (Rainfall = 35.63 inches; Cecil soils).

Land Class	II	III	IV
Slope length	105'	70'	35'
Slope	3%	7%	11%
	tons/ac.	tons/ac.	tons/ac.
Cropping Practice			
1. Continuous cotton	1.04	9.47	7.51
2. Oats after disced down row crop	1.74	7.72	10.09
3. Vetch planted in furrows between 1947 cotton rows	.61	1.39	--
4. First year Kobe lespedeza and oats residue	--	.08	.25
5. Second year Kobe lespedeza residue	--	0	.14
6. Eighth year sericea hay residue	--	--	0

Winter Cover Crops in Peach Orchards - John T. Bregger, Clemson, S. C.-"The winter cover crops made an ideal growth this spring, partly due to a generous fall application of 3-9-6 fertilizer. Rye apparently responds much more to such treatment than the various legumes, based on the greatly increased yield over previous seasons. The following table is presented to show approximate yields of such cover crop species as were tested on a plot or field basis.

ORCHARD COVER CROP YIELDS IN 1948

Cover Crop Species	Calculated Yield, T/A*	
	Green	Dry
Rye (Abruzzi variety)	30	4.0
Hairy vetch	8.35	1.4
LeConte vetch	5.0	.8
So. spotted bur clover	12.5	2.0
Crimson clover	8.0	1.67
Button clover	5.0	1.15
Rose clover	7.5	1.5

* Tons per acre as of April 23, 1948

"A new type of cover crop management is being studied for the first time this year. It involves use of a heavy stalk cutter (1740 pounds) with revolving blades approximately ten inches apart that knock down and cut the cover crop into sections. Due to its more tender state, the hairy vetch was almost completely cut off in the first operation while the tougher rye was laid flat on the ground. Most of it did not remain green, however, which indicates it was either cut or broken off near the base of each stalk.

For providing a mulch type of ground cover, this treatment appears to be ideal. What remains to be studied is its comparative effects on nitrogen tieup as compared with disk tillage which buries a certain percentage of the cover crop residues within the soil."

Crop Growth on Austin Clay From Different Depths in the Soil Profile - J. R. Johnston, Temple, Texas.-"Some fertility work on Austin clay profile layers has been started in order to observe plant growth habits on the different profile layers. The different layers of soil have been considered representative of land at various stages of sheet erosion. Bulk samples were taken from 6-inch layers from the 0-6" depth through the 30-36" depth. Soil from these various layers was placed in greenhouse pots. One series was planted to oats, a representative of the grasses. The other series was planted to hubam sweetclover, a soil improving crop. The oats series was treated with 3 levels of nitrogen fertilizer- 0, 25, and 50 lbs. N per acre as ammonium nitrate. The sweetclover series was treated with 3 levels of phosphorus fertilizer - 0, 25, and 50 lbs. P₂O₅ per acre.

"The oats have not been harvested to date. The growth of these plants in the 2 top layers of soil has been good regardless of nitrogen fertilization. Growth in the other 4 layers has been very poor regardless of nitrogen fertilization. One might conclude from these observations that nitrogen fertilization alone is not sufficient for establishing good grass cover on badly eroded land in this area.

"The sweetclover plants have been harvested and the amount of top growth determined. The data in Table 1 shows the effect of phosphate fertilization on sweetclover growing on different layers of Austin clay soil. Some soil analyses data are also given in this table.

Table 1.--Certain soil analyses data for Austin clay profile layers and the effect of phosphorus fertilization on sweetclover growth.

Profile layer	Organic matter content*	Total Nitrogen	Soluble Phosphorus**	No fert.	25lb.P ₂ O ₅	50lb.P ₂ O ₅
Inches	Percent	Percent	ppm.	gms/pot	gms/pot	gms/pot
0-6	2.81	0.107	5.6	12.92	15.76	15.33
6-12	1.75	.086	4.1	4.21	12.17	12.08
12-18	1.05	.071	3.8	.11	8.88	9.16
18-24	.48	.036	2.7	.14	6.52	8.98
24-30	.07	.024	2.4	.33	7.99	7.61
30-36	.03	.017	2.9	.05	5.17	6.42

* Chromic acid oxidation method

** CO₂ method - available phosphorus

*** All data are averages of 3 replicates.

"These data show that sweetclover growth is directly related to the organic matter and nitrogen content of the soil.. The low amount of sweetclover growth in the 4 lower layers was overcome somewhat by phosphate fertilization. This high response to phosphate fertilization suggests that the way to improve the badly eroded soils of the area is to grow sweetclover and use phosphate fertilizer."

Widespread Interest in Earthworms - Henry Hopp, Beltsville, Maryland.

"The public interest in the possibility of managing the earthworm fauna for soil improvement has now reached unprecedented and amazing levels. During the past winter, the earthworm project handled almost a thousand inquiries on this subject. Newspapers and magazines are repeatedly citing our work. At the moment SUCCESSFUL FARMING and the NEW YORK MIRROR SUNDAY supplement are writing stories about it. Radio station WGN, Chicago, has made a tape-recorded interview and will broadcast it over their morning farm program in the near future. One of several technical articles we now have in press has been accepted for the new journal of the Agronomy Society, 'What's New in Soils and Crops.'

"Soil conservationists should realize that earthworms are among the most obvious forms of soil life, and when people notice them, they wonder what effects they are producing, and call upon the technical specialists for the answers. With such obvious widespread interest on the part of the public, soils specialists might well check up on the magnitude of earthworm activity in their soils rather than accept too categorically the old idea that earthworms are of no practical importance for conservation."

Earthworms in Pastures - C. A. Van Doren, Urbana, Illinois. - "Mr. Gard has submitted earthworm counts and weights on pasture plots which were sampled in April and last December. The figures in Table I are average values of five samples, each one foot square and eight inches deep. The average live weights of worms was considerably greater on the treated, moderately grazed plot. Moderately grazed plots on both treated and untreated soil had a high total weight of live worms. No logical explanation is advanced for the greater number of worms on the untreated plots.

Treatment	Bare Ground %	Ave. No. Worms per Sq. Foot		Wt. Worms per Sq. Ft. (gms.)		Ave. Live Wt. Worms (gms.)	
		Dec.	Apr.	Dec.	Apr.	Dec.	Apr.
		1947	1948	1947	1948	1947	1948
Treated, severely grazed	5	24.6	6.4	9.38	1.68	0.38	0.26
Treated, moderately grazed	0	15.2	7.2	8.18	4.85	0.54	0.67
Untreated, severely grazed	14	4.3	9.4	1.60	2.68	0.37	0.28
Untreated, moderately grazed	0	18.0	19.6	3.21	4.68	0.18	0.24

Organic Matter Increases, 0-6", during 10 Years as Influenced by Treatment and Management of Pastures - "Professor S. W. Melsted, Soil Fertility Div., Illinois Agricultural Experiment Station, has reported organic matter analyses of samples taken in 1937 and again in 1948 on the pasture plots at Dixon Springs. The treated, moderately grazed plots on both replicates had the greatest increase in organic matter over the ten year period. Decreases which occurred on some of the severely grazed and on the untreated plots are not large which indicates that organic matter can be maintained on most pasture land regardless of treatment. Some of the inconsistencies may be explained by a careful analysis of the type of vegetation (forage crops and weeds) which developed as a result of the different treatments.

Treatment Grazing Management	Replicate No. 1			Replicate No. 2		
	1937 Lbs./A.	1948 Lbs./A.	Differ. Lbs./A.	1937 Lbs./A.	1948 Lbs./A.	Differ. Lbs./A.
Lime, phosphate, severe	37,150	50,910	✓13,760	42,650	41,620	- 1,030
	35,080	42,480	✓ 7,400	41,550	41,280	- 270
Lime, phosphate, moderate	35,770	52,970	✓17,200	47,470	55,040	✓ 7,570
	35,080	56,760	✓21,680	40,860	54,070	✓13,210
Untreated, severe	50,220	47,470	- 2,750	46,090	52,280	✓ 6,190
	42,310	43,340	✓ 1,030	42,200	45,540	✓ 3,340
	37,150	37,840	✓ 690			
	41,550	39,900	- 1,650			
Untreated, moderate	43,680	46,440	✓ 2,760	52,280	46,440	- 5,840
	37,840	40,070	✓ 2,230	48,670	48,160	- 510

Organic Material Produced by Winter Covers and Land Rest Covers -
O. R. Neal, New Brunswick, New Jersey. "At the time of spring plowing on the Marlboro experimental areas, measurements of organic material turned under are made. Such measurements include only the plant tops and roots that are in recognizable form. As a result the quantities reported represent a minimum in all cases. Presumably with winter cover crops most of the organic matter produced is measured. Where the land has been in sod or other resting treatment during the preceding year and much of the total plant material has partially decomposed, the figures reported are doubtless very conservative. Furthermore, benefits to the physical condition of the soil resulting from the absence of cultivation during the previous year are not measured at all by this process. With these limitations in mind the following quantities are reported.

Organic Matter at Time of Plowing - 1948			
Treatment	Organic Matter		
	Tons/Ac. - Oven dry		
	Tops	Roots	Total
Rye cover after sweet corn on contour	.67	1.66	2.33
Rye cover after sweet corn up and down slope	.63	.94	1.57
Ryegrass cover after sweet corn	.50	2.47	2.97
Ryegrass and vetch after sweet corn	1.97	2.21	4.18
Clover and timothy seeded fall of 1946	2.5	2.9	5.4
Lespedeza sericea 3-year old stand	17.3	2.6	19.9

"Rye seeded on the contour as winter cover after contoured sweet corn made considerably greater growth than did the same crop planted up and down slope. Ryegrass and vetch made more growth than did any of the other cover crops. Sweet corn following this cover crop mixture has shown a consistently higher yield than is obtained following the other cover crops.

"The clover-timothy had one hay cutting removed in 1947. In addition to this removal it appears that a considerable quantity of the plant material produced had decomposed beyond recognition prior to sampling.

"The lespedeza had been clipped but no top growth removed during the 3-year period of growth. Since this material decomposes relatively slowly there was a large accumulation at the time of sampling."

Climatic Hazards of Erosion - D. B. Krimgold, Washington, D. C.-
 "Partial analysis of soil-loss and precipitation data from the Marlboro, N. J. plots indicates an exponential relationship between soil-loss in July and $P_{1.00}$ - the amount of precipitation falling at rates greater than 1.00 per hour. This relationship is somewhat better defined for rains in July and August when the plot was freshly cultivated and the vegetal cover was 30 to 50 percent. The relationship is further improved when the soil loss is plotted against $3P_{1.00} + 2P_{0.25} + P_5$,

where $P_{1.00}$ and $P_{0.25}$ are the amounts of rainfall falling at rates greater than 1.00 and 0.25 inch per hour, and P_5 is the total rainfall for the storm plus the rainfall for four preceding days.

"No such relationship was found for another group of rains during which the vegetal cover was less than 25 percent. Multiple correlation analysis of records obtained when the soil was frozen and both rainfall and snowmelt were involved, indicate significant correlation between the logarithms of soil loss and the logarithms of $P_{0.25}$ and of P - total precipitation for the storm. The logarithms of soil also correlate significantly with $P_{0.25}$. The correlation of the logarithm of soil loss with P alone was not significant.

"The work done so far indicates that even for the same slope and the same soil and cover characteristics no valid quantitative relationship can be established between erosion and precipitation unless other variables are eliminated or properly accounted for.

"Soil loss due to rainfall and/or snowmelt on a plot or a similar undissected area with given slope (length, degree, and shape), soil characteristics and vegetal cover can be expressed functionally in the following manner:

$$S.L. = a P_f^x + b (P_{fc} - P_f)^y + c (P - P_{fc})^z + d (P - P_{fc} - D)^w$$

Where:

S.L. is soil loss

a, b, c, d and x, y, z, and w are numerical coefficients and exponents determined by the slope, soil, and vegetal cover.

P_f is the amount of rainfall or snowmelt occurring at rates greater than the rate of movement of water into and through the soil when it is not saturated. It is also a measure of the amount of rain falling with energy (drop sizes) sufficient to detach soil particles and to break up the aggregates in the surface soil.

P_{fc} is the amount of precipitation - rainfall or snowmelt or both occurring at rates greater than the rate of transmission of water through the soil or at rates greater than the rate of movement of water into the soil after it is sealed by slackening action of water or by raindrop impact.

P is the total rainfall or snowmelt directly associated with the soil loss.

D is the difference between the maximum water holding capacity of a "specified depth" of soil and the moisture content at the beginning of the precipitation or snowmelt period which is directly associated with the soil loss. The "specified depth" will depend on the structure and texture of the soil. It will be greater for a well aggregated or coarse textured soil and less for a dispersed soil.

"Simplified versions of this general expression are applicable under certain conditions. For instance, during summer months snowmelt need not be considered. During periods of low intensity rainfall $P_f = 0$. During prolonged wet spells as in the dormant season of humid regions, D may be zero. During the height of the growing season of certain crops D for the "specified depth" may not vary greatly or antecedent rainfall may be a good measure of D.

"The apparently satisfactory relationships found for the Marlboro plot in July and August probably represents one of such special cases. Better and more valid relationships could be found if instead of assuming $P_f = P_{1.00}$ and $P_{fc} = 0.25$, these values were determined experimentally."

DIVISION OF DRAINAGE AND WATER CONTROL

Hydrologic Studies - R. W. Baird, Waco, Texas. - "Total rainfall for the month was 5.53 inches at rain gage No. 69. At other locations the rainfall was considerably greater. Most of the rain occurred in two storms, April 12-13 (2.09 inches and April 25 (2.74 inches). Both of these storms caused some runoff from all stations and at most stations the runoff on April 25 was at the highest rates since May 1946.

"The table on page 10 shows the rainfall amounts for different time intervals and the maximum runoff rates and total amounts for the two major storms of the month. The rain of April 12-13 was uniform over the Y and W areas but the rain of April 25 was considerably heavier in the W area.

"In contrast with results from the spring of 1947 the smaller areas in Y with a small amount of grassland had more runoff than the larger areas which include a larger percent of grassland. At the end of the month there was no flow from any of the stations in the area with conservation practices, (Y), and only a small amount at Stations W-1 and W-2 (areas without conservation practices). The deep subsoil and ground water has not yet been replenished to a very great extent but the surface 3 or 4 feet has a good supply of soil moisture.

"The area SW-17 which is being returned to pasture has runoff rates and amounts comparable to cultivated land. This is as should be expected on an area spot sodded with Bermuda grass and seeded with Hubam clover and oats in January. The condition of this area should change quite rapidly with present good moisture conditions and the warmer weather suitable for Bermuda grass growth. The native meadow area (SW-12) had very small rates and amounts of runoff for these two storms."

Hydrologic Studies - George A. Grabb, Jr., East Lansing, Michigan. - "In response to a request from the State Soil Conservationist, the Red Cedar River was sampled April 28 at a point on the College Campus to determine the silt content. River was at a slight high water stage of 5.40 feet following 0.62 inch precipitation over a 3-day period, and was found to be carrying silt at a rate of 1,058 tons per day. Data was made available to Operations personnel with the offer to perform necessary analysis of samples taken by Operations personnel whenever advisable.

"Preparation of punch cards showing all available data to January 1, 1947 for cultivated and wooded watershed precipitation, solar radiation, and evaporation was completed during the period. Considerable amount of time was personally spent by the Project Supervisor in the Tabulating Department, MSC, in the checking, sorting, and collating of this material preparatory to proof-reading. Personal attention to details of this study on the part of the Project Supervisor is necessary in view of the original and experimental nature of the study. Key-punching of data in

Table 1.--Blacklands Experimental Watershed
Waco, Tex.

Storm April 12-13, 1948										Storm April 25, 1948									
Rainfall amounts in inches					Runoff					Rainfall amounts in inches					Runoff				
: 5min:10min:15min:20min:25min:Total:Ins / hr.: Amt.:5min:10min:15min:20min:25min:Total:Ins / hr.: Amt.					: Max. Rate:Total:					: Max. Rate:Total:					: Max. Rate:Total:				
W-1	.270	.395	.496	.541	.610	2.074	.273		.3935	.387	.718	1.025	1.277	1.470	3.105	*	*		*
176 acres																			
W-2	.230	.400	.522	.556	.594	2.010	.153		.2238	.410	.764	1.114	1.352	1.542	3.198	1.03	1.330		
130 acres																			
W-6	.210	.400	.510	.540	.590	2.010	.101		.1183	.410	.760	1.090	1.320	1.510	3.190	1.53	1.0973		
42.3 acres																			
W-10	.260	.400	.540	.580	.600	2.010	.501		.7337	.410	.770	1.150	1.400	1.590	3.210	2.61	1.4946		
19.7 acres																			
AREAS WITHOUT CONSERVATION PRACTICES																			
AREAS WITH CONSERVATION PRACTICES																			
Y	.305	.419	.516	.552	.612	2.061	.0512		.1081	.348	.634	.910	1.150	1.377	2.946	.683	1.0115		
309 acres																			
Y-2	.304	.416	.512	.552	.609	2.079	.0534		.0998	.327	.612	.872	1.096	1.340	2.889	.822	1.0817		
132 acres																			
Y-4	.308	.416	.510	.549	.599	2.085	.0503		.1013	.312	.591	.842	1.057	1.288	2.845	.586	.8097		
79.9 acres																			
Y-6	.291	.410	.510	.559	.638	2.080	.0963		.1742	.367	.635	.983	1.183	1.470	2.982	.954	.8491		
20.9 acres																			
Y-7	.304	.408	.508	.540	.610	2.037	.166		.2987	.406	.711	1.012	1.246	1.436	3.067	1.42	1.1766		
40.0 acres																			
Y-10	.317	.419	.510	.542	.576	2.087	.285		.3031	.278	.534	.768	.979	1.177	2.760	.883	.8326		
21 acres																			
SW-12	.310	.410	.500	.530	.560	2.050	.0180		.0141	.290	.480	.710	.960	1.250	2.830	.296	.2523		
2.97 acres																			
SW-17	.260	.390	.490	.540	.610	2.090	1.48		.7477	.380	.720	1.030	1.290	1.480	3.120	3.58	1.9976		
2.99 acres																			

* Record for this station not yet computed.

regard to soil temperatures and percent of soil moistures at different levels on the three watersheds is under way. One student was employed on a part-time basis to prepare the original data for key-punching."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minnesota.-
"Mr. Blaisdell and Miss Gosslin continued their analysis of the rating curve for box inlet drop spillway. It now appears that we have finally developed a satisfactory method of grouping the results of the tests for all approach channel widths and box inlet shapes when the flow over the weir is not affected by submergence. The equation,

$$Q = c_1 L \sqrt{2g} (H_e - 0.01W)^{3/2},$$

should give results to within + 5 percent in discharge and + 8 percent in head where Q is the discharge in cubic feet per second, B the box inlet length in feet, W the box inlet width in feet, L the crest length in feet $(2B + W)$, H_e the observed head plus the velocity head at the head measuring section in feet, and c_1 a coefficient which has the values

B/W	0.5	1.0	2.0
c_1	0.440	0.430	0.418.

When the width of the approach channel, W_c , is less than three times the crest length, a correction to c_1 is required. Since it appears that an approach channel $3L$ wide can rarely be expected under field conditions, c_1 will ordinarily be less than the values given here. For narrow approach channels c_1 may be reduced by 50 percent or more.

"The above method of presenting the results is open to some objection because of the head correction factor $(0.01W)$. The results can be presented in the form of a curve if the head correction factor is eliminated. The rating equation then becomes

$$Q = c_2 L \sqrt{2g} H_e^{3/2}.$$

The coefficient, c_2 , varies with values of H_e/L less than 0.10. When H_e/L is equal to or greater than 0.10, $c_2 = 0.405 \pm 5$ percent. Since $H_e/L = 0.10$ the upper limit of practical application, c_2 will be less than 0.405 for the majority of field installations. A curve has been prepared to give values of c_2 when H_e/L is between 0.02 and 0.10. A box inlet shape correction factor must be applied to c_2 . Its value is 1.000 for $B/W = 2$, 1.029 for $B/W = 1$, and 1.053 for $B/W = 0.5$. The same approach channel width correction factor must be applied to c_2 as was applied to c_1 .

"Mr. M. M. Culp and Mr. A. F. Moratz of the Region 3 Engineering Division spent April 26 and 27 at the Laboratory discussing the results we have obtained and leaving with us some of their practical information which will be of value in making our studies. We were told that drop inlet spillways are now favored two or three to one over all other structures in Region 3. Last year the division was more nearly even -- 131 drop inlet spillway plans, 110 drop spillway plans, 33 drop box plans, and 20 other plans being prepared for a total of 305."

Hydraulic Studies - W. O. Ree, Stillwater, Oklahoma.--"The following experiments were run during this period:

Channel	: Expt.	: Cover	: No. of : Flows
FCL	5	Dormant grass mixture	9
	6	Dormant grass mixture	9
	7	Burned stubble	7
FC2	5	Dormant lovegrass	4
	6	Burned lovegrass stubble	8

"Experiment 5 on channel FCL was run during the first part of January. A heavy snow fall had occurred about a week before. At the time of the experiment the snow was melting and runoff was occurring naturally in the field. The soil in the channel bed which had frozen was thawing out. Since channels are probably weakest when the bed soil is thawing out a test at that time should indicate the minimum permissible velocity. Accordingly the channel was tested when this combination occurred.

"Channel FCL is lined with a native grass mixture consisting mainly of Bermuda grass and little bluestem. At the time of experiment 5 the cover was the dead stubble of these grasses varying in length from 4 inches to 30 inches. There were a number of small scoured areas in both the 3 percent and 6 percent slope reaches of the channel. In general, however, its condition could be classed as good. Nine flows were run down the channel ranging from 0.7 to 74.5 cubic feet per second. Excessive erosion started taking place during the seventh test in and around the scoured areas. The velocities during the seventh test were 2.39 feet per second on the 3 percent slope and 3.23 feet per second on the 6 percent slope. It is judged that the permissible velocity for this channel at the time of the tests was about 2.5 feet per second. If the cover had been complete the permissible velocity would probably have been between 3.0 and 3.5 feet per second. It appears that bare soil is more easily eroded (detached) when in a thawing out condition.

"Channel FC8 is one of the new channels constructed during the period. It is a field type channel about 300 feet long with a bed slope of 6 percent. The cross section is triangular with side slopes of 1 on 10 and a width of 40 feet. It has been planted to yellow bluestem. After the channel had been rough graded a seep developed about a third of the way down the slope. From there down the bottom of the channel was a soft mud impossible to finish grade or to plant. It was necessary to install a tile under drain to dry up the channel. A 4-inch clay tile was laid down the center line of the channel 2 feet below grade. Within 48 hours of the installation of the drain it was possible to cultivate the channel bed. Heavy rains later damaged the channel but scour fortunately was not deep enough to reach the tile line.

"Channel FC7 was also constructed during this period. It is a field type channel about 1,200 feet long on a slope of 0.02 percent. Its cross section is triangular with side slopes of 1 on 4 and a width of 24 feet. For the present it will be left bare. Its main purpose is to afford a check on the VR design method for very light slopes. In such cases the product of VR consists of more R and less V than the channels previously tested in the laboratory."

Sedimentation Studies - L. C. Gottschalk, Washington, D. C.-

"The work on the inventory of published and unpublished sediment-load data was completed this month. This inventory was prepared under the supervision of the Sedimentation Section in cooperation with agencies represented on the Subcommittee on Sedimentation, Federal Inter-Agency River Basin Committee."

Drainage Studies - M. H. Gallatin, Homestead, Florida.-

"Moisture readings for this period of low rainfall as well as a low water table show that for limes or citrus the irrigation cycle should not be more than 7 days if the moisture content of the soil is to be held above the wilting point. For avocados, mature groves having an abundant accumulation of organic matter, a cycle of 8-10 days is adequate to maintain good moisture conditions. Shade and accumulation of organic materials directly influence the cycle on all types of groves.

"Moisture readings on our mulch plots for the period held the same relationship as for the previous month, that is the increase has been in the following order: check, natural cover, pine straw, grass and shavings. An area mulched with shavings will retain moisture longer than any of the other materials. Analysis of nitrate samples from the mulch plots show a steady rise in nitrates for the grass mulched area, while there has been no increase for any of the other plots.

"During this period on one of the groves on which Uramon was applied at rates of 1/2, 3/4, and 1 pound per tree broadcast by overhead irrigation, we had a rain of 2.75 inches in approximately 2 hours. The Uramon was

applied on February 2 and the peak of breakdown as nitrates occurred on March 8 when there was 126 p.p.m. of nitrates. In the afternoon of March 8, 2.75 inches of rain fell and the following week on March 16 analysis showed that the nitrates had dropped to 47 p.p.m. Subsequent weekly samplings have shown decreases to 29 p.p.m. on March 30 and 26 p.p.m. on April 5. The foregoing samples were taken just under the canopy of the tree. Samples from the middles taken in the same grove show that the maximum release occurred on February 23, 99 p.p.m. Following the heavy rain of March 8 the nitrates dropped from 58 p.p.m. to 18 p.p.m. on March 16 with a subsequent drop during the rest of the period."

IRRIGATION DIVISION

Snow Surveys - George D. Clyde, Logan, Utah.-"Dean K. Fuhrman reports all snow surveys completed and water supply forecasts issued for major Utah streams. Radio broadcasts were made giving the water supply outlook for Utah streams. Water supplies for Utah will be near normal with some high spring flows expected from low snow deposited during late April on most of the watersheds. Reservoir storage is above normal and many of the reservoirs will spill water this spring."

Upper Santa Ana River - Dean C. Muckel, Pomona, Calif.-"Field studies to be carried on during the 1948 irrigation season in Yucaipa Valley Soil Conservation District were started during the month. Soil samples were taken in 10 orchards to determine the soil moisture content resulting from winter rains. In many places, rains were not sufficient to supply the necessary water to carry the orchards into the regular season schedule, which starts May 3. Consequently, many growers were purchasing an extra early run of irrigation water. Substantial differences were noted between orchards with winter cover crops and no cover crops with the soil moisture apparently being depleted by the cover crops. Rainfall was considerably below normal and this is probably not the usual condition."

Permeability Studies - V. S. Aronovici, Pomona, Calif.-"Mr. R. E. Uhland visited this project for nearly 10 days. The purpose was to demonstrate the use of the permeability equipment developed by the Research Staff in Washington. Two sites were selected in the Yucaipa Valley Soil Conservation District for demonstration purposes. One field planted to peaches was cultivated with a cover crop incorporated into the surface. The second field in grapefruit was non-cultivated, clean tilled, and a cotton hull surface mulch. Undisturbed cores were taken from both locations and processed in the Pomona laboratory. Final calculations are as yet not completed; however, it was demonstrated that the permeability index of the surface foot of the non-cultivated soil was nearly three times as high as the clean cultivated field. Moisture conditions were considerably better in the non-cultivated field."

San Fernando Valley Drainage Investigation - W. W. Donnan, Los Angeles, Calif.-"Progress for the first 8 months of the field studies on drainage were reviewed at a meeting of the Board of Directors of the San Fernando Valley Soil Conservation District on April 6, 1948. Field experiments with leaking artesian wells continues. On those wells where there is no visible flow out the top of the well, but where leakage is suspected between strata, various methods of detecting this flow have been attempted. The flow is, in many cases, too small to detect with flow meters but still significant as a contribution to the high ground water in adjacent areas. To determine whether there is flow, a method has been tried with some success as follows:

"An insulated rubber-covered wire, with a small platinum electrode is lowered into the well and conductance readings are taken at 5-foot intervals to 150 feet. A quarter-inch plastic tube is lowered to about 60 feet and 2 gallons of salt brine are pumped into the well. This brine will gradually diffuse downward from the 60-foot level, since it is heavier than the well water. However, if there is any upward flow of artesian water from below the 60-foot level, the salt solution will be diffused upward and can easily be detected by subsequent conductance readings. If no salt solution is apparent above 60 feet, the plastic tubing is raised 20 feet and more brine pumped into the well. The presence and source of artesian leakage has been charted in this manner, although no quantitative data are obtainable."

Imperial Valley Investigations - Harry F. Blaney, Los Angeles, Calif.-
"A provisional 'Progress Report on Cooperative Investigations in Imperial Valley, California, for Year 1947' was completed by L. W. Donnan and George B. Bradshaw. This report presents the results of the 1947 studies on permeability, drainage tile spacing, leaching, deep drainage wells, East Mesa water-table, experiment farm, and evaporation from Salton Sea. Appendices to this report were prepared by V. S. Aronovici on 'Tile Effect of Soil Solution Concentration Upon Evaluating Soil Salinity', and 'Technique for Estimating Quantity of water to be Drained by Drainage Facility' for Imperial Valley. These reports were presented and discussed at the annual meeting of the Imperial Valley Drainage Committee on April 19, 1948."

Technical Assistance to Texas Water Conservation Association - Wells A. Hutchins.-The entire month was devoted to the rendering of technical assistance to the Texas Water Conservation Association in connection with its program of preparing water laws for Texas -- a revision of the present surface-water code, and a new ground-water code. This cooperation was arranged by an exchange of letters between George D. Clyde, Chief of the Division of Irrigation, and Judge J. E. Sturrock, General Manager of the Association. The Department is loaning Mr. Hutchins' services, and the Association is paying all travel and subsistence expense. Complete drafts of the proposed water-law measures were prepared by Judge Sturrock with Mr. Hutchins' assistance. These drafts were being mimeographed and will be sent to the members of the Water Laws Committee of the Association, who will meet with Judge Sturrock and Mr. Hutchins at Houston, Tex., May 7 and 8 in order to review and to pass upon the drafts. The following week will be spent assisting Judge Sturrock in revising the drafts in accordance with the instructions of the Committee.

Snow Surveys and Streamflow Forecasting - Clyde E. Houston.-The final water supply outlook for irrigation season water supplies in Nevada, as determined by snow surveys on over 100 snow courses in the State is for short supplies throughout the main irrigated valleys. Runoff will range

from 25 to 50 percent of normal from the Sierra and from normal to 60 percent from the headwaters and main stem of the Humboldt. Reservoir storage is poor with total storage on April 1 about 45 percent of last year, 60 percent of the 1937-46 average, and 55 percent of the usable capacity. Lake Mead contained about 115 percent of last year's storage on April 1.

On April 7 three conferences were held to initiate Area Forecast Committees. These meetings were called by the Division of Irrigation. The morning of April 7 a meeting was held in the office of the County Agent in Minden, Nevada, to determine irrigation season water supplies for the Upper Carson Valley. At every meeting the opinion of the participants was unanimous that such a meeting should be held each year to be attended by all interested farmers so that they could learn first-hand how much irrigation water could be expected for the next irrigation season. The technicians felt that information gained from such meetings was invaluable in appraising and assisting with their programs. The State Engineer's office recommended that meetings such as the above be extended to all other irrigated areas in the State. The Division of Irrigation agreed insofar as personnel is available.

Irrigation Requirements of Crops - Paul A. Ewing.-A preliminary description of irrigation practices in Pajaro Valley was completed. This manuscript will be circulated and discussed with Messrs. Blaney, Simpson and Seibert, after which final estimates of irrigation applications will be made. As intimated in previous reports, overall deliveries probably average about 2-1/4 acre-feet per acre and total some 27,500 acre-feet annually. On the whole, this is indicative of fairly economical practice, considering nature of the agriculture.

Flow of Water in Irrigation Conduits - Fred C. Scobey.-The tests made by Fred C. Scobey at the request of the General Manager of the Metropolitan Water District of Southern California on the 72-mile San Diego Aqueduct some months ago have been completed, so that this report is a brief summary of results as now computed. Tests were run on 12 reaches of pipe varying in internal diameter from 48 inches to 96 inches, in length of reach from 7.376 feet to 54.973 feet. Velocities ranged from 2.98 feet per second in reach No. 1 to 7.97 feet per second in reach No. 9. Values of "n" ranged from 0.0102 to 0.108. Details of these tests will be prepared for the technical press.

Snow Surveys - Carl Rohwer, Fort Collins, Colo.-The results of the April 1 snow surveys on the Colorado, Missouri-Arkansas and Rio Grande drainage basins were published on April 10. A special summary of the data was prepared for the West-Wide report. Press and radio releases were prepared which were given considerable publicity. The snow surveys and reports on reservoir storage indicate that the irrigation water supply outlook is favorable in the Rocky Mountain area from Montana to New Mexico. The outlook for Arizona is still unfavorable although some improvement in conditions occurred during March.

Mr. Parshall prepared a paper for the Western Snow conference on "Forecasting of Runoff Based on Water Content of Snow Corrected by a Factor Involving Fall Flow of the Stream."

Seepage from Irrigation Channels - Carl Rohwer.-The page proof of the report on "Seepage Losses from Irrigation Channels" was received from the printer early in April. The proof has been checked and returned to the printer. Although the galley proof of the report was available in January so many errors were found in it that it was necessary to reset the entire report. This has caused considerable delay.

Silt Studies - Dean W. Bloodgood, Austin, Texas.-On April 19, Messrs. H. A. Beckwith (Board Member), Ivan M. Stout (Testing Engineer), and I visited and inspected silt conditions at Medina Lake which is located 30 miles northwest of San Antonio. On April 29, Messrs. H. A. Beckwith, Victor Jones (Geologist on Sedimentation Survey, SCS), and I again visited the area for a more complete reconnaissance inspection and survey at the same site. The original capacity of this lake was 254,000 acre-feet. In 1925-26 a silt survey was made by our Division in cooperation with the Texas Board of Water Engineers. In 1937 another survey was made by Dr. Victor Jones in cooperation with our Division of Irrigation and Texas Board of Water Engineers. Since the dam was constructed (about 35 years ago), Dr. Jones has calculated by sedimentation surveys that the capacity is being reduced at a yearly rate of about 0.08 percent. The lake is practically dry at the present time (5 to 6 feet of water in the narrow main stream channel above the dam) and the silt deposits have dried out considerably so that in many places an automobile can travel over them easily. The entire silt deposit of the reservoir bed is exposed and another silt survey at this time would be easy and could be made with little expense. The present condition of the lake bed prompted those interested in sedimentation deposits of large reservoirs to attempt to have another survey made before the Medina Lake refilled again. As a consequence, the Texas Board of Water Engineers, the Soil Conservation Service represented by Sedimentation Surveys (Dr. Victor Jones who will have supervision of the survey), and Division of Irrigation Research, and Bexar, Medina, and Atascosa Counties Water Improvement District No. 1 will cooperate immediately with the survey. This work should be started early in May. Samples of silt deposits have already been obtained for analyses. The reservoir is used for irrigation purposes.

Irrigation Studies.-On April 6 to 8, Messrs. H. A. Beckwith (Board Member), C. E. Ellsworth, District Engineer of the U.S.G.S., and I made a trip to the Eagle Pass area where we inspected sites for the measurement of excess waters from irrigated lands (surface drainage water that flows to the natural stream channels) and excess waters from canals which return to the Rio Grande and is used by other irrigation districts

in the Lower Rio Grande Valley. The available flow for irrigation purposes is approximately 500 second-feet on which about 75 to 100 second-feet is returned to the Rio Grande from one source or another. When the irrigated area of the District increases, the waste water will probably be utilized for a more beneficial use.

While in the area, I inspected the measuring devices that have been installed for measurement of irrigation water. All of them were functioning very nicely.

At the Jack Keisling farm below El Indio, the recorder charts showed he used an irrigation head of 4.59 second-feet in irrigating about 125 acres of cotton. At the time of my visit he was replanting cotton. I was informed some of the first planting had been killed by frost.

The spinach season was about over and much of the land was being prepared for cotton (summer crop), tomatoes, cabbage, carrots, broccoli, and cauliflower (late summer and fall crops). The acreage planted to Bermuda onions is large and the crop is about matured. I understand the yield of Number One grade of onions is larger than usual and that some of the crops are being sold in the field at \$700 per acre. The onion crop is the most successful and profitable in the 50 years of onion growing. The gross receipts of one area is estimated at \$5,000,000. Still the water is not measured and there are no data on water requirements for onions.

The low water diversion dam being constructed by the District on the Rio Grande below the headworks of the Main Canal for the Eagle Pass area is about completed. This dam should increase the flow of water into the canal and give the District the amount granted them in their water permit. The capacity of the main canal is designed to carry about 1,500 second-feet. Approximately 30,000 acres are being irrigated of a total of about 60,000 irrigable acres in the District. The next item on the water program of the District is to line about 27 miles of canals and during this construction to install concrete Parshall flumes for the measurement of water. These improvements are necessary in connection with our future irrigation studies.

Irrigation Studies (Rice).—On the 14th, Mr. Ivan M. Stout, our state co-operative assistant, and I made a trip to the Katy area where we made tentative arrangements with farm cooperators for carrying on rice irrigation studies during 1948. We inspected the Ray Wood farm south of Hockley--this farm was considered 2 years ago--and selected a location for the installation of a 6-inch metal Parshall flume. Mr. Wood estimates his pumping plant is capable of furnishing about 1,500 g.p.m. Last year we inspected the plant at intervals throughout the season, and it was noted there was considerable decrease in flow near the end of the irrigation season. Mr. Wood will make a good cooperator. His rice farm will contain about 300 acres. The rice growers' acreage varies each

year according to the field being irrigated. The usual practice is plant the same rice land once in three years.

On the 22nd we made another trip to the Katy area where we installed a 6-inch Parshall flume, equipped with a flow recorder, for the measurement of water to the Ray Wood rice farm near Hockley. The soils of this farm contain more sand than those of the Brookshire area. In order to prevent the flume from washing out we installed it in a soil-cement mixture. We used two sacks of cement and about 1 cubic yard of sandy loam soil. There was considerable moisture in the soil and sufficient to cause the cement to set. The cement was mixed with dry soil and there were no measured amounts in the mixture. The material was tramped in place with the feet. Where the soil was too dry, we added a little water with a sprinkler. Before we left the installation the mixture had begun to set and to harden.

Snow Surveys and Water Supply Forecasting - James C. Marr, Boise, Idaho.- The snow surveys made by Marr and Griddle, as well as several hundred made elsewhere in Columbia Basin by cooperators, give assurance that there will be no serious water shortage. However, dwindling supplies in storage reservoirs in southeastern Oregon may indicate water shortage in those areas next year in event above normal precipitation fails to occur.

The Snow Surveys and Water Supply Forecast report comprising 35 pages of mimeographed material was completed during the first 10 days of April and mailed out to approximately 450 interested organizations and individuals. The snow survey material and forecasts were also released through the press and by radio on April 10.

Ivan D. Wood, Denver, Colo.-During the month the illustrated circular "Profitable Pumping Practices" was completed. This circular was originally planned for some 20 pages, but was increased in size on the advice of Messrs. Parshall, Code, and Rohwer, members of the Soil Conservation Service at Fort Collins. Assistance in preparation of the bulletin was obtained from personnel at Ft. Collins, as well as pump manufacturers, well men, and contractors.

Hugh C. McKay, St. Anthony, Idaho.-The most important factor in determining winter kill is the lay of the land. North slopes and low spots where the snow tends to lay the longest seem to kill out the worst. The type of rotation being followed also determines the extent of winter kill. On our sweet clover and alfalfa rotation plots where a legume had been plowed down very little winter killing occurred. These plots will not have to be reseeded. This conforms to observations made in previous years. The type of tillage also plays an important part in the extent of winter killing. It was felt previously that stubble-mulch tillage did not increase snow mold or snow scald but this year's observations do not bear this out. On high ground not susceptible to winter kill there is no difference between any of the tillage practices regarding their effect on

winter kill. In the low areas where winter killing occurs there is definitely more winter killing in the stubble mulch plots than in the moldboard plowed plots. All of the moldboard plowed plots came through the winter with but a small amount of winter kill. The fall plowed moldboard plots were especially good indicating that a firm seed bed is important. In the one way disk and stubble mulch plots there was from 40 to 80 percent winter kill depending on the location.

This is a serious factor in our dry land area and should be given careful study especially as we are trying to establish stubble mulch tillage as an erosion control practice.

R. A. Work, Medford, Oregon.-In Berkeley, Paul Ewing and R. A. Work collaborated in preparation of the West-Wide Water Supply Forecast, which was furnished for release to Reclamation Era, Western Construction News and Electrical West, as well as to the Current Information Section of Soil Conservation Service in Washington, D. C.

Experimentation - Stephen J. Mech, Prosser, Washington.-All plots were irrigated within a 6-day period and their moisture levels were very close together. This will therefore give a check on their infiltration rates at fairly uniform moisture conditions at the time of irrigation. It will have a bearing on the question of whether the limiting factor in infiltration is the limited wetted area or is it some characteristic below the surface and within the soil itself.

It is generally agreed that infiltration is less under the higher soil moisture conditions and greater under dry soil conditions. Yet instantaneous infiltration rates taken from curves obtained for plots irrigated when in a wet, moist and dry condition showed a consistent difference in infiltration rate. Values obtained after 10 hours of irrigation have shown an average infiltration rate of 1.8, 2.2, and 2.6 cubic feet per minute per plot for the wet, moist, and dry conditions respectively. This is perplexing because after a 10-hour irrigation it seems that all furrows would be surrounded on all sides by a foot or more of saturated soil. If this wet shell were the limiting factor the rates would be similar regardless of the initial moisture conditions.

A manuscript entitled "The Influence of Crop and Crop Rotation on Some Irrigation Characteristics of Sagemoor Fine Sandy Loam Soil" was prepared and is being submitted for approval as part of the 1948 Annual Field Day Report for the Irrigation Experiment Station.

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